AEC-NASA TECH BRIEF

Nondestructive Evaluation of Printed Wiring Boards by Microhm Resistance Measurements

The reliability of printed wiring boards has become increasingly important as their use in electronic packaging has grown. The quality of feed-through connections on printed wiring boards has been of major interest in the last two or three years, and considerable effort has been expended in the evaluation of various feed-through techniques.

Present evaluation methods have serious deficiencies. Metallographic examination is destructive, costly, and time-consuming, and must, therefore, be limited to a small sample. The current-carrying and resistivity tests are usually performed on sample circuits and may not represent the condition of the actual product. In addition, the current-carrying test produces stresses which may damage the circuits being tested. Visual inspection is highly subjective and depends upon the skill of the operator. Also, gold and tin-lead coatings on printed wiring boards often hide defects in the copper plating, especially in the hard-to-see hole areas.

Sandia Laboratories has developed an effective microhm measuring circuit for the nondestructive evaluation of printed wiring boards. When combined with appropriate probes, application of the circuit to the measurement of plated-through hole resistances provides quantitative data that can be related to the quality of the copper plating. Acceptance limits can be established and continuous inspection performed, with plating defects causing abnormal readings.

The circuit used is an adaptation of the 4-wire method of measuring very small resistances. Current is passed through a resistive body and auxiliary wires are used to measure the voltage developed across the body. In an instrument shunt, large high-conductivity blocks are provided on each end to allow uniform current density over the resistor. The voltage is then measured by connecting voltage probes at either side of the resistive body.

Because of the relationships of gold, solder, and copper, and the thicknesses in which they are normally used, the presence of gold or solder protective coatings does not significantly affect the measurements. Sensitivity is adequate to allow measurement of one hole at a time. A 100 percent test rate may be employed if quality requirements for a specific product warrant it. Currents used are sufficiently small to prevent stress conditions in any but the most miniature printed wiring boards.

Notes:

1. Once the equipment is set up, no skills other than those required for simple voltage or current readings are needed by the operator. Measurements are made quickly and the results are available instantly.
2. Available documentation includes a computer program for obtaining calibration charts for plated-through holes. This technique could be applied to an automatic testing and data collection system.
3. Inquiries concerning this innovation may be directed to:

   Sandia Office of Industrial Cooperation
   Org. 3416
   Sandia Laboratories
   Albuquerque, New Mexico 87115
   Reference: B69-10272

Patent status:

No patent action is contemplated by AEC or NASA.

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Category 01